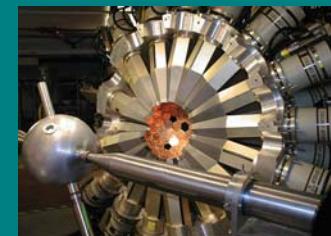


# Search for Hyperdeformation in Xe Nuclei

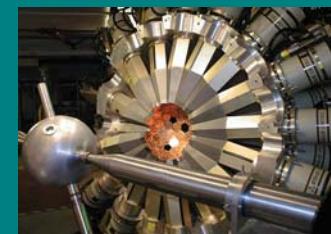
Geirr Sletten, NBI, Copenhagen.

- Predictions
- Experiments
- Analysis of continuum and resolved spectra
- Conclusions



# Collaboration

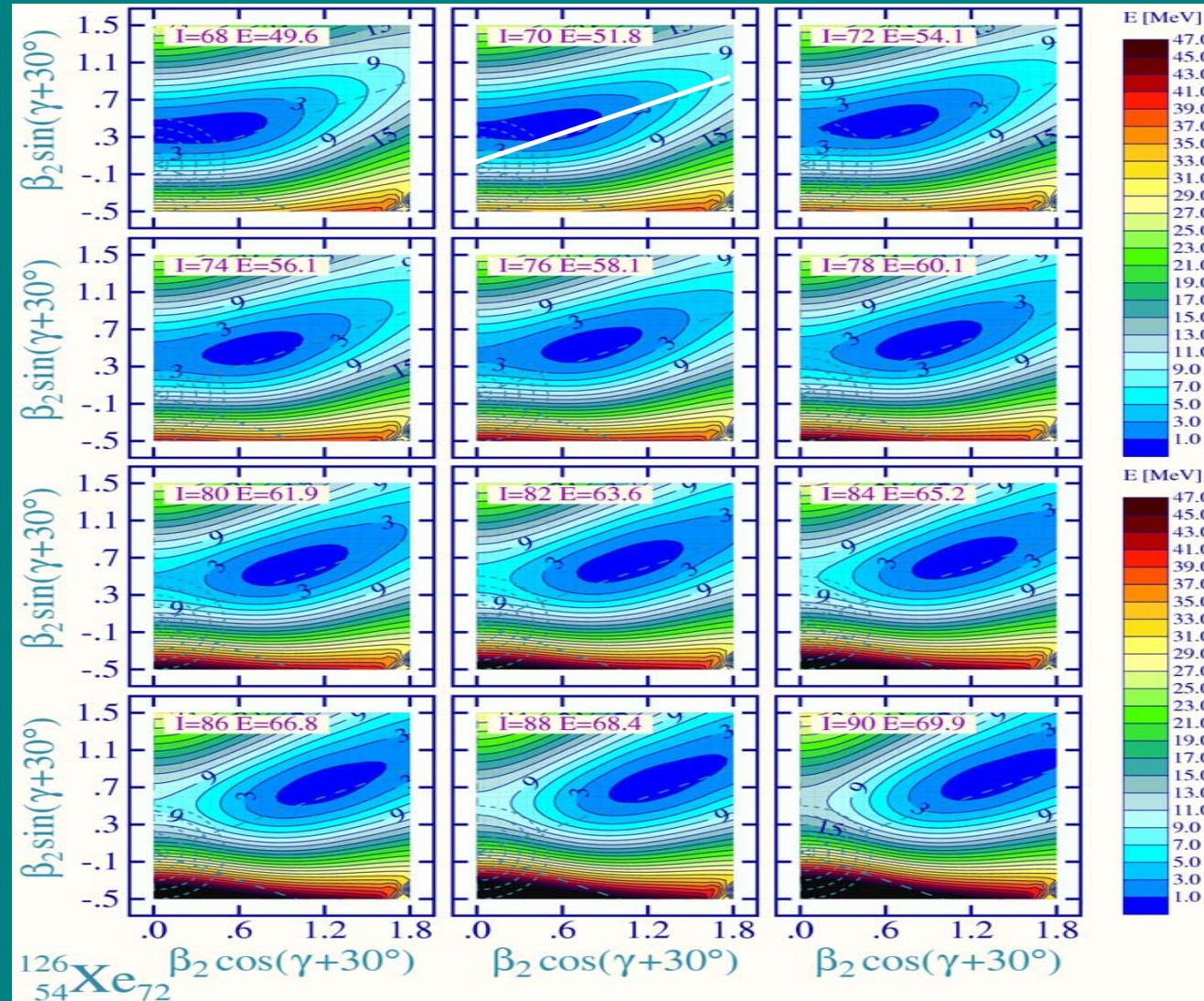
- C. Rønn Hansen - NBI, Copenhagen  
G. Hagemann  
B. Herskind  
D.R. Jensen  
G. Sletten  
J.N. Wilson  
S.W. Ødegård
- P. Bringel - Universität, Bonn  
C. Engelhardt  
H. Hübel  
A. Neusser  
A.K. Singh
- G. Benzoni - INFN, Milano  
A. Bracco  
F. Camera  
S. Leoni
- A. Maj - NINP, Krakow
- P. Bednarczyk - IReS, Strasbourg  
T. Byrski  
D. Curien
- A. Korichi  
J. Roccaz
- J.C. Lisle - Schuster Laboratory
- T. Steinhardt  
O. Thelen
- M.P. Carpenter - ANL  
R.V.F. Janssens  
T.L. Khoo  
T. Lauritsen
- R.M. Clark - LBNL  
P. Fallon
- 10 laboratories, 31 persons



# Liquid Drop Calculations

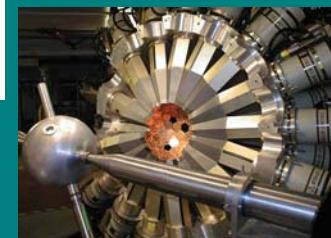
Pomorski and Dudek, PRC 67 (2003) 044316

$\beta_2 \sin(\gamma + 30^\circ)$

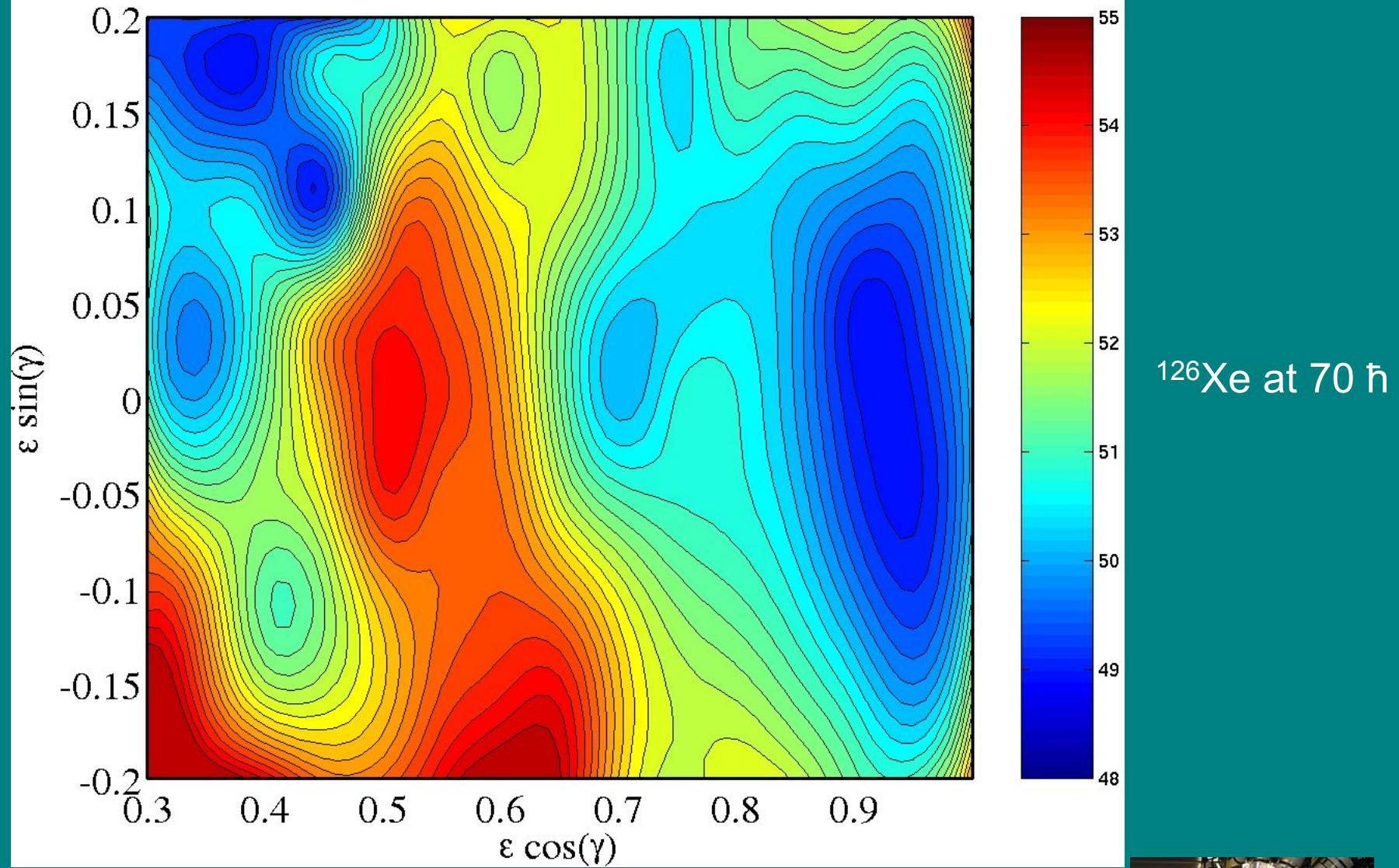


$\beta_2 \cos(\gamma + 30^\circ)$

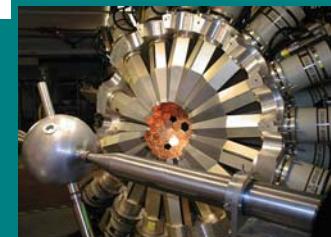
Nuclei at the limits, ANL 2004



Potential energy surface for  $^{126}\text{Xe}$ ,  $I = 70$ ,  $\pi = +1$ ,  $\alpha = 0$

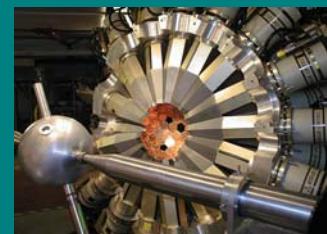


R. Bengtsson, <http://www.matfys.lth.se/~ragnar/ultimate.html>.

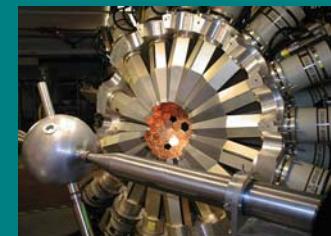
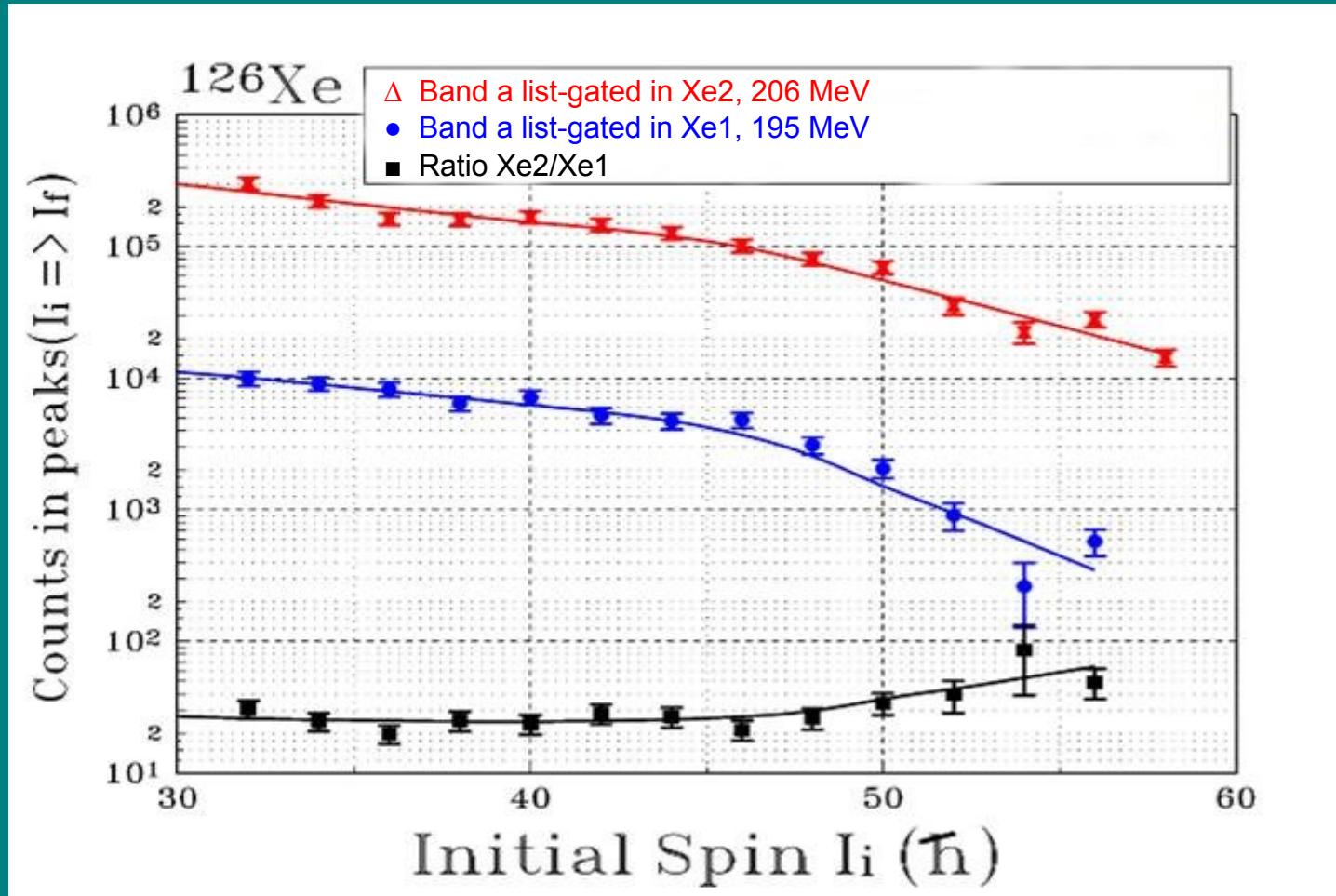


# Experiments

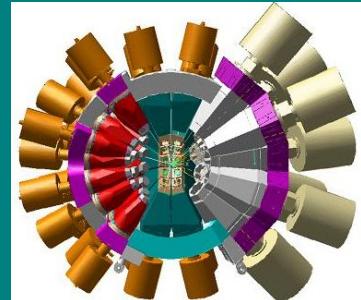
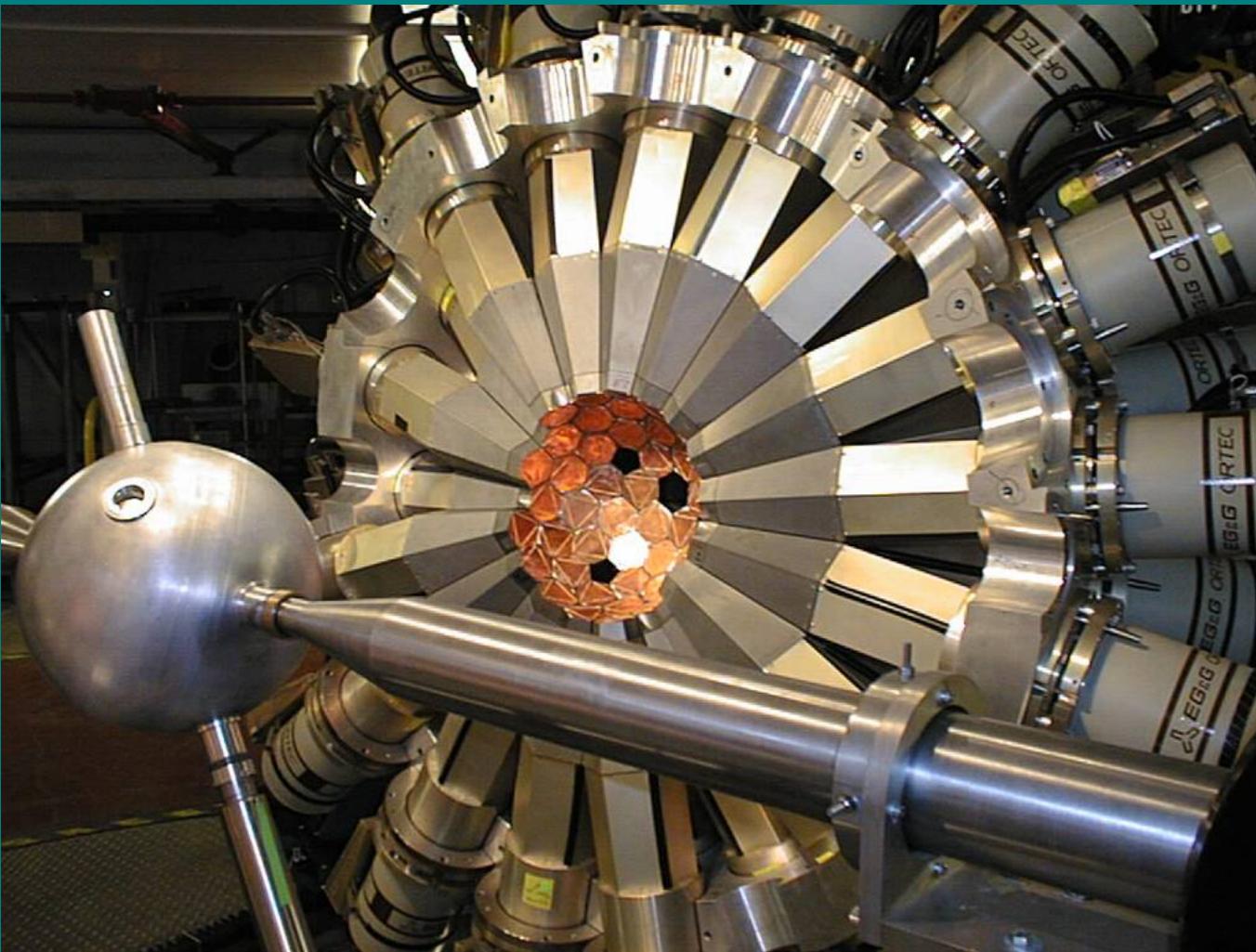
- Reaction :  $^{82}\text{Se} ( ^{48}\text{Ca}, \text{xn} ) ^{130-x}\text{Xe}$
- Xe-1 with the Vivitron and Euroball-VI in June 2001,  $E_b = 195 \text{ MeV}$ . Analysis completed.
- Xe-2 with ATLAS and Gammasphere in December 2003,  $E_b = 206 \text{ MeV}$ . Analysis in progress.



# Population of yrast states in Xe1 and Xe2 experiments.

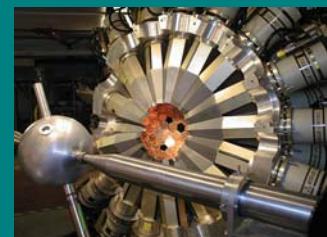
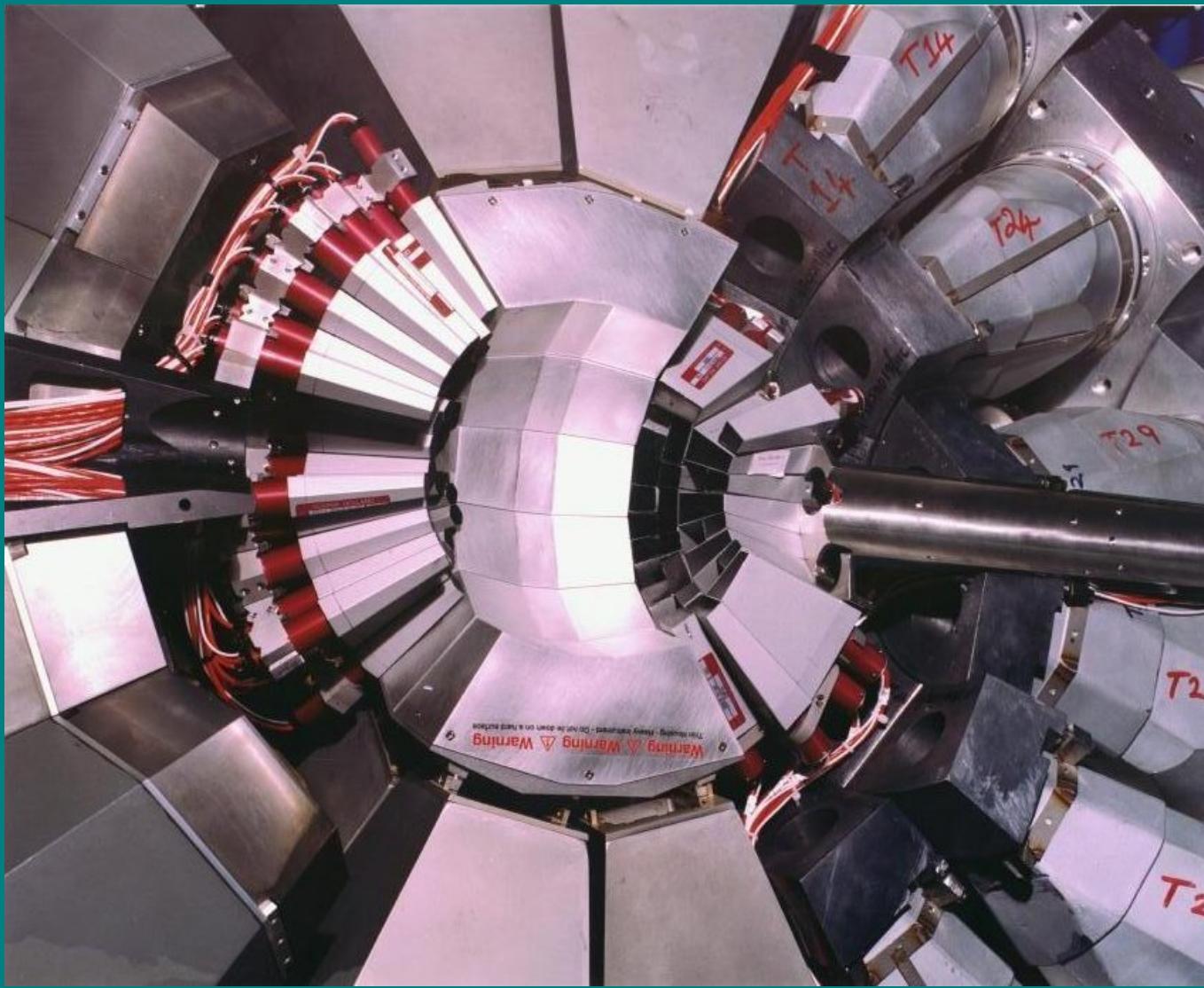


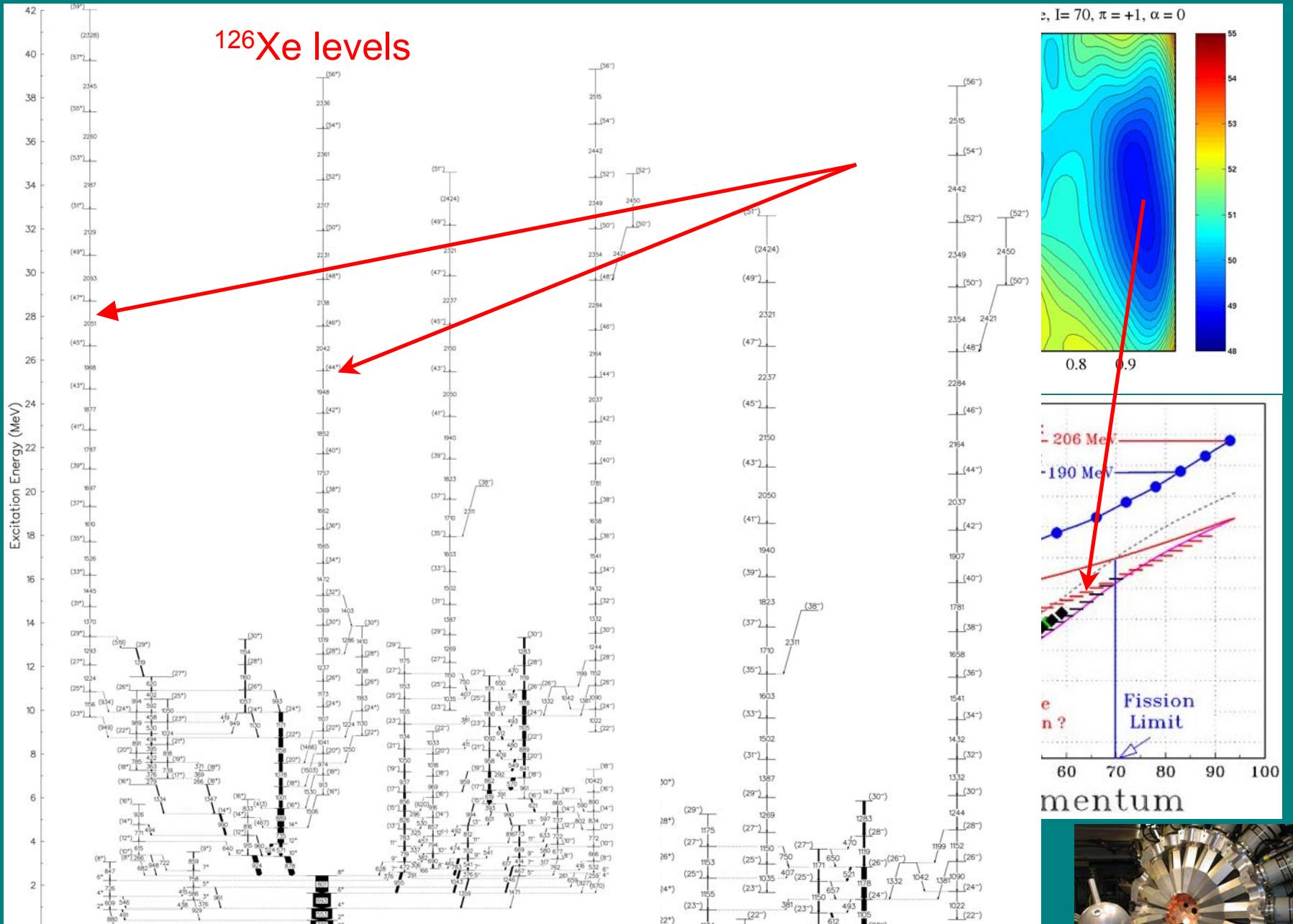
# Gammasphere.



Nuclei at the limits, ANL 2004

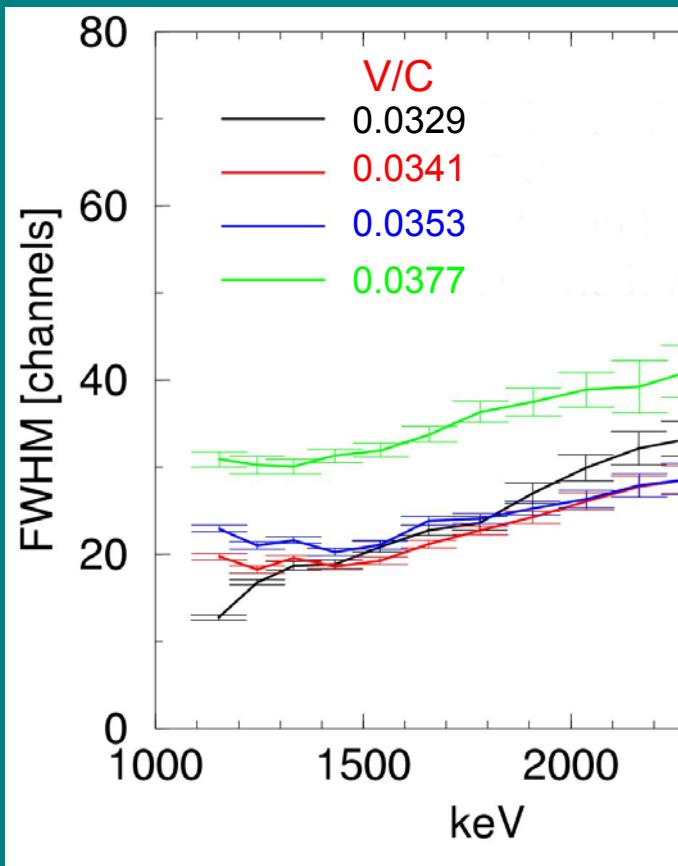
## Euroball with the BGO innerball.



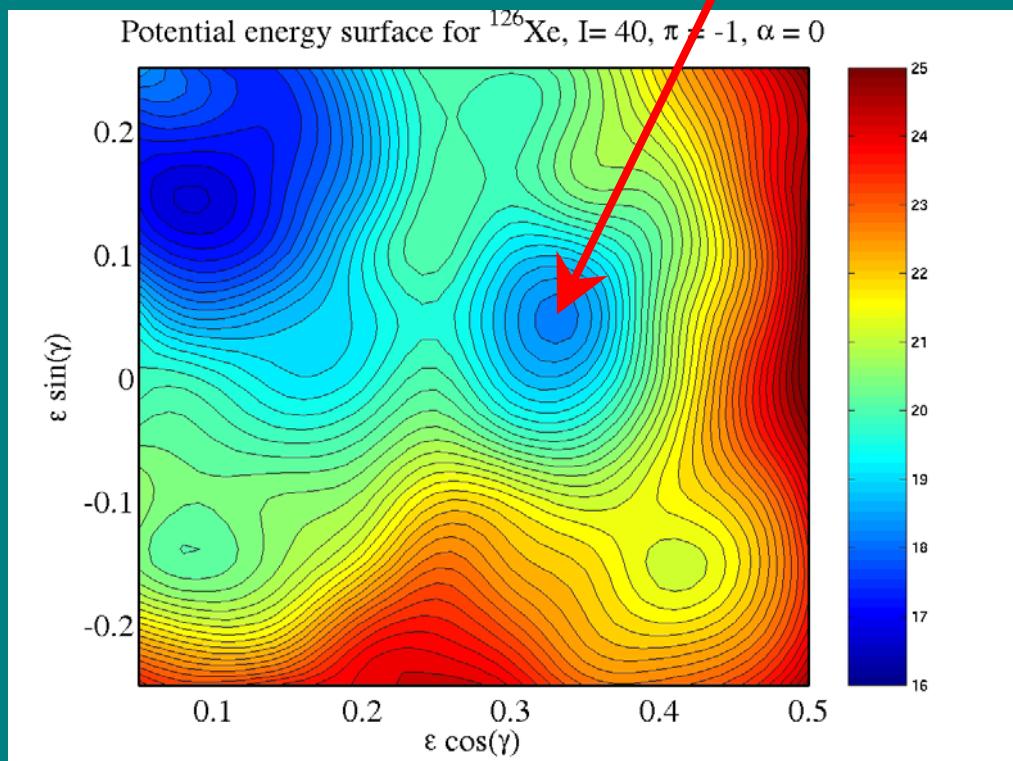


Nuclei at the limits, ANL 2004

## Lifetime estimates in band a



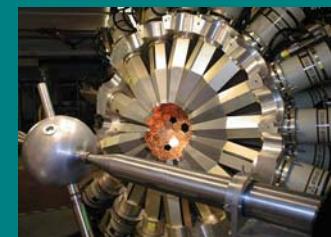
$\varepsilon \sim 0.35$ ,  $\gamma \sim +5^0$ ,  $Q_2 \sim 550$  barn



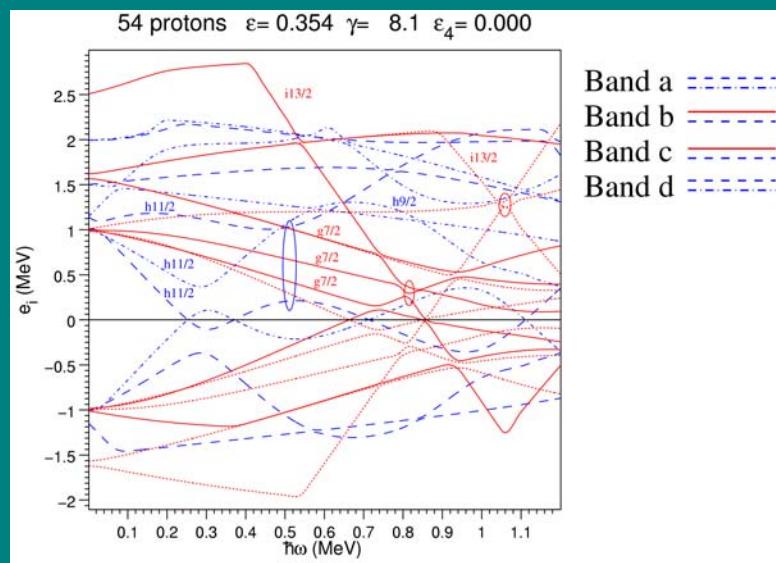
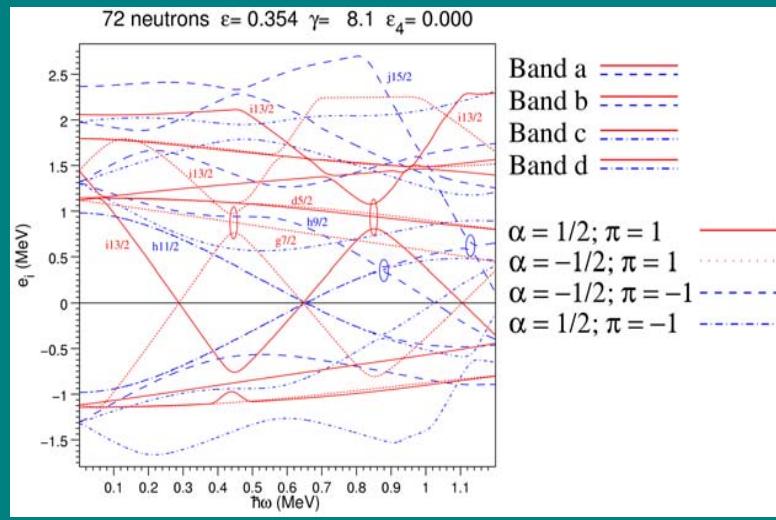
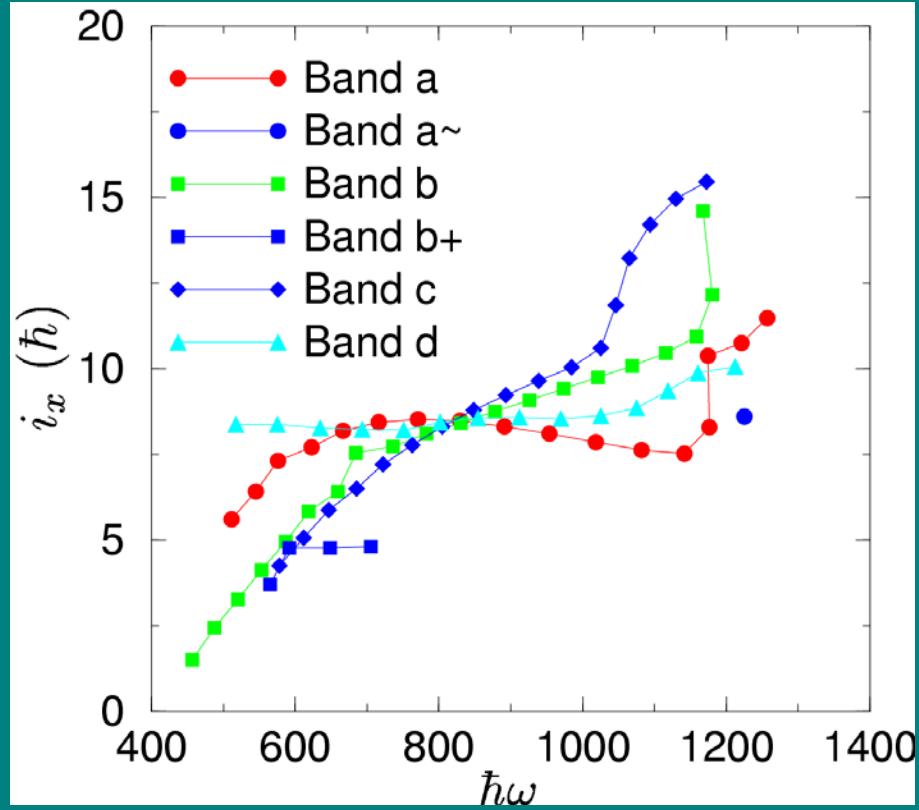
UC prediction for HD :  $Q_2 \sim 2400$  barn

Recoils pass  $\frac{1}{2}$  target in  $\sim 50$  fs

Estimated  $Q_2 \sim 500$  barn



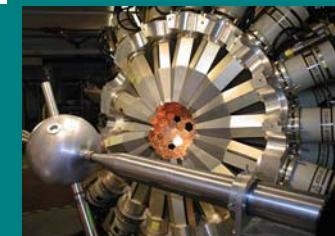
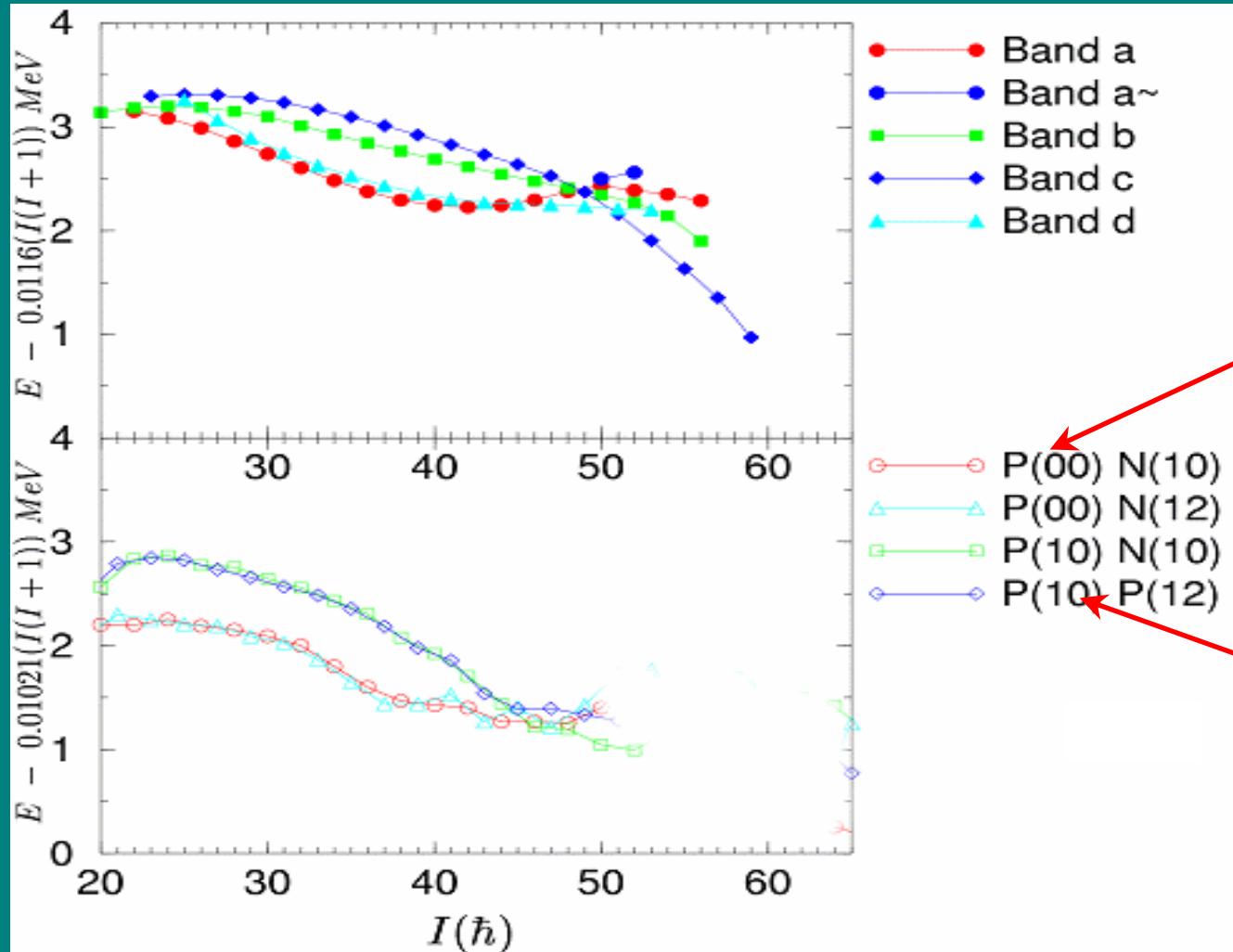
# Alignment in $^{126}\text{Xe}$



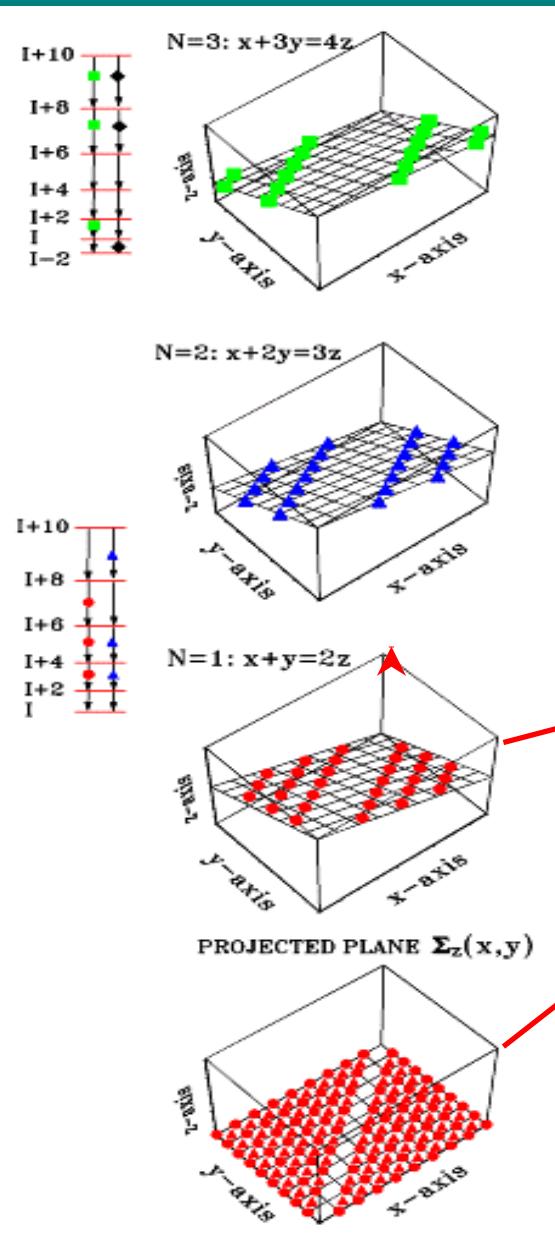
Single particle  
Routhians for  $^{126}\text{Xe}$



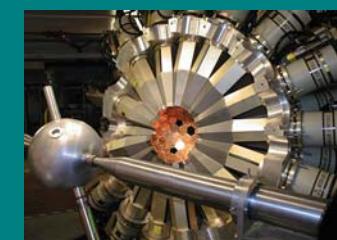
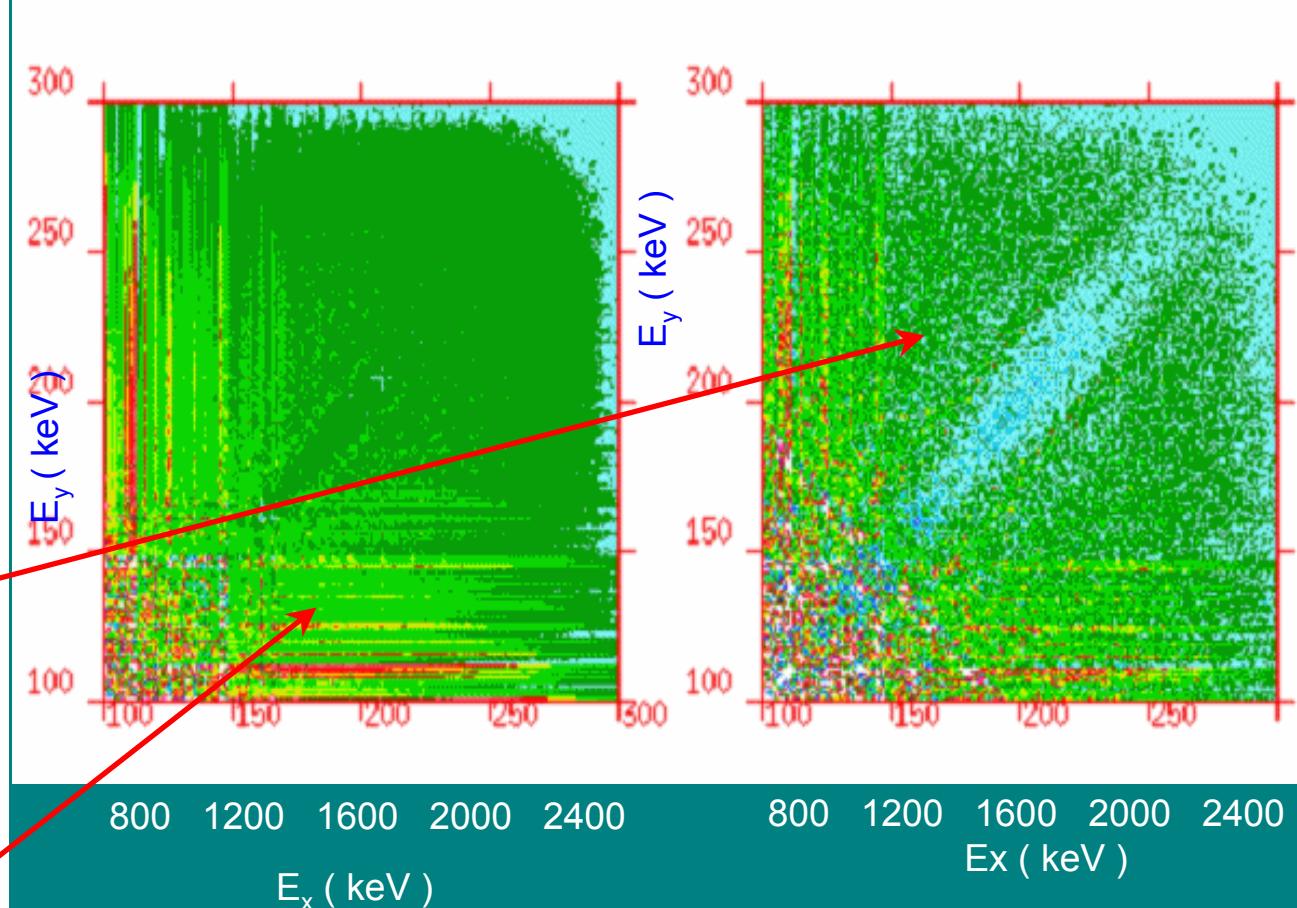
# $^{126}\text{Xe}$ level energies vz UC predictions



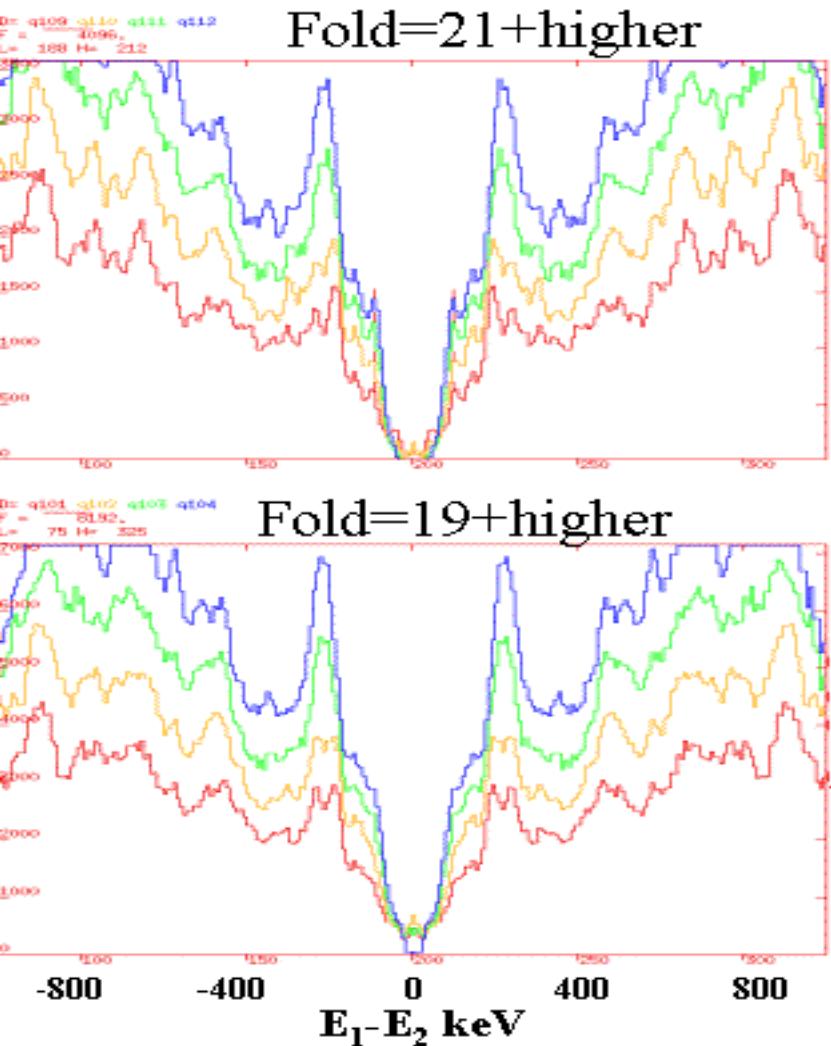
## Rotational plane mapping (RPM)



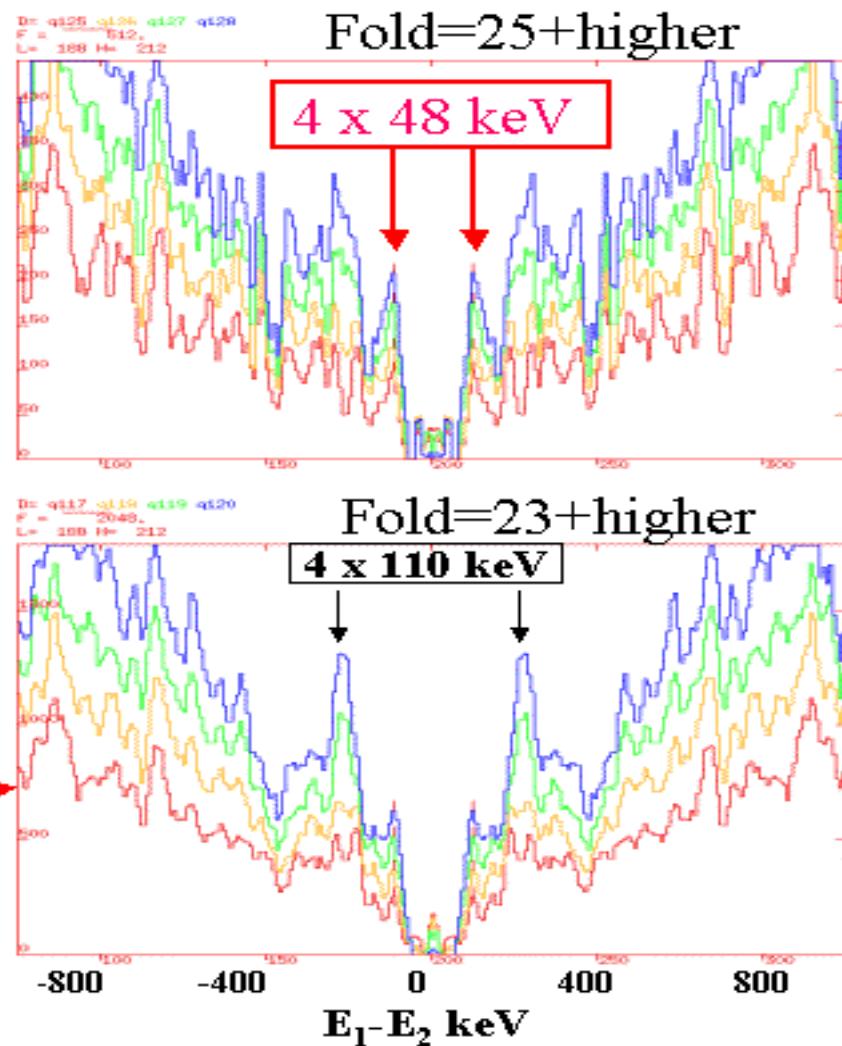
RPM on Xe-2 data,  $N = 1$  :  $E_x + E_y - 2E_z = \delta$   
 $\delta = 8$  keV



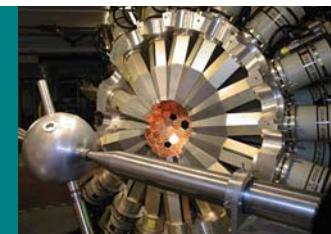
# Perpendicular Cuts at $(E_1+E_2)/2=1360$ keV for different folds and width:



Width (keV)  
184  
152  
120  
88

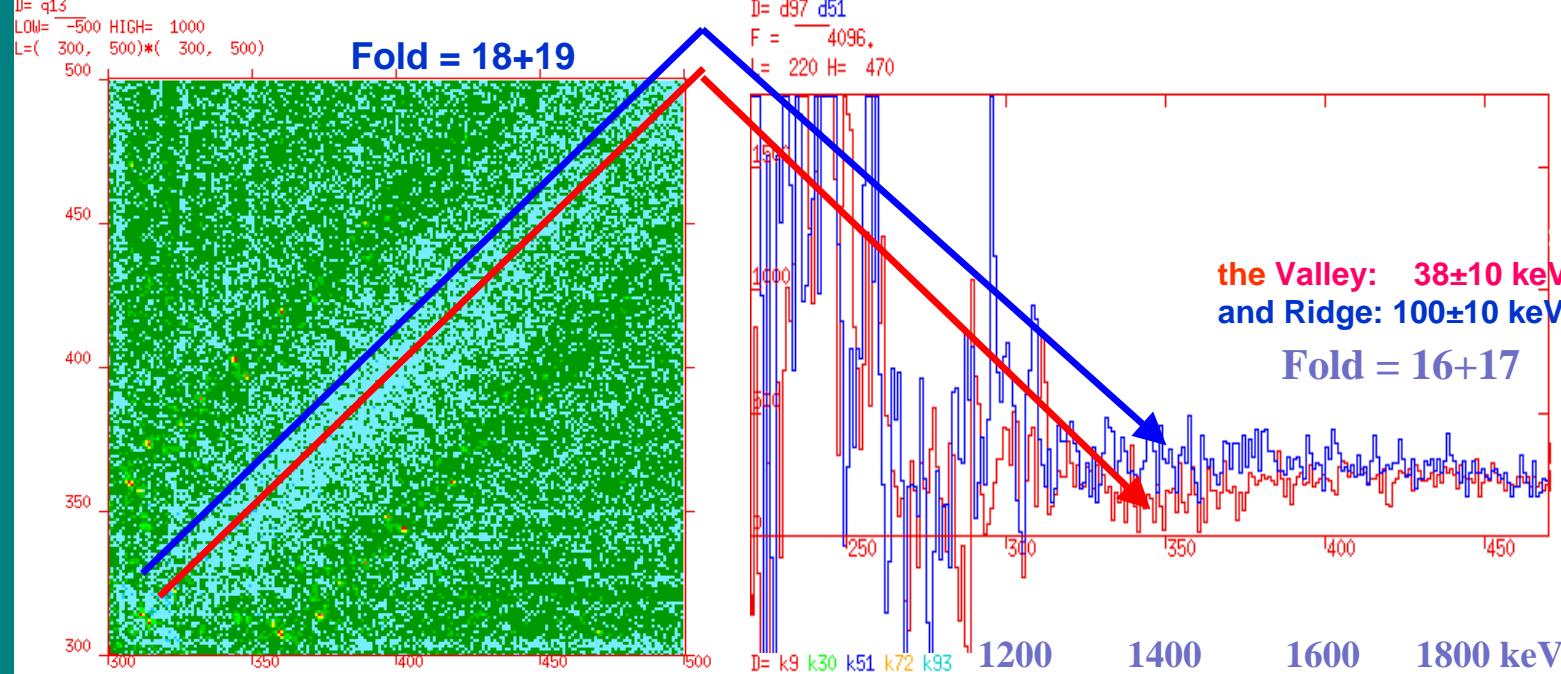


Xe1 dataset – Euroball, inner ball selection

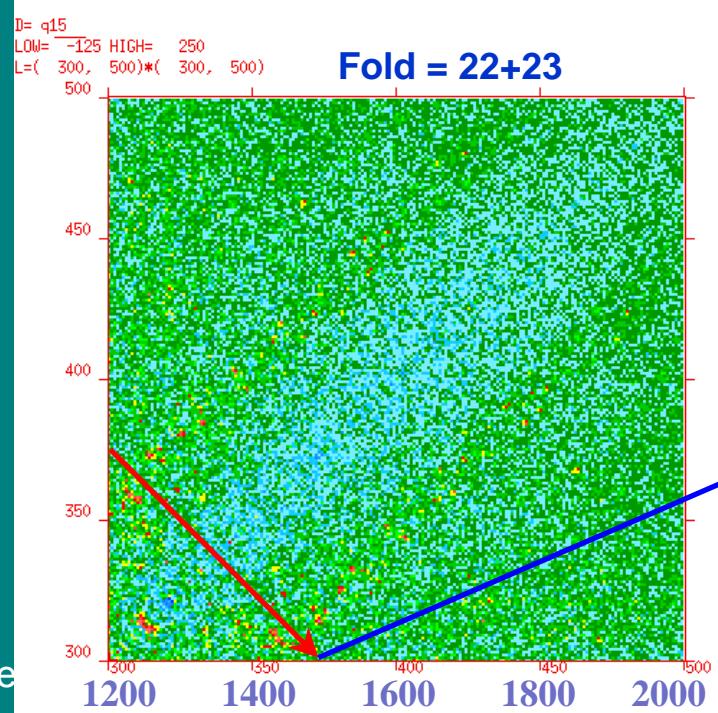


# Xe-2

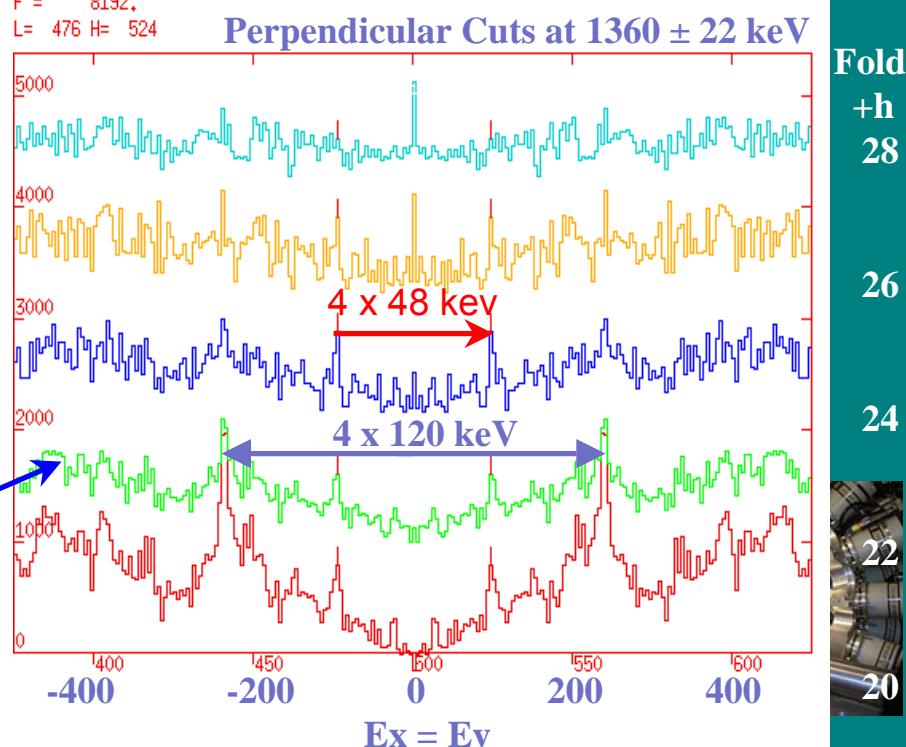
Cut  
along  
valley

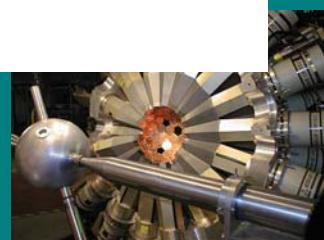
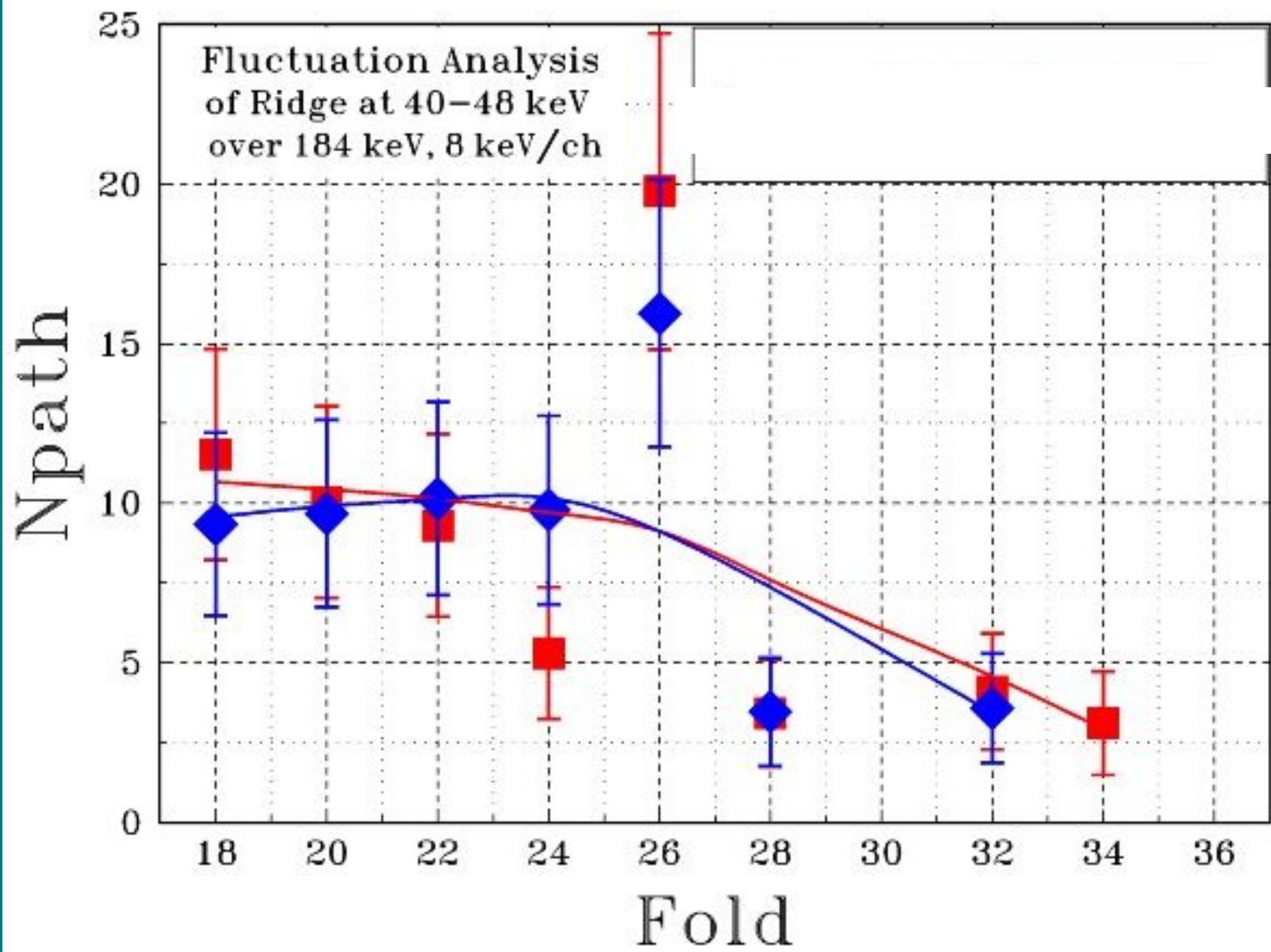


Perpen-  
dicular  
cut



Nuclei at the





# Conclusions

- Regular bands of discrete transitions identified to  $I \sim 60 \hbar$  which is  $\sim 10 \hbar$  lower than the expected crossing with hyperdeformed bands.
- Ridges corresponding to  $\Delta E\gamma = 48 \text{ keV}$  are observed in the unresolved spectra. This is compatible with a rotating prolate nucleus with hyperdeformed shape and dynamic moment of inertia  $\sim 85 \text{ MeV}^{-1} \hbar^2$ .
- Fluctuation analysis of the hyperdeformed ridge gives a lower limit of 10 bands contributing to the ridge.
- The experimental results compare well with theoretical calculations. The experimental sensitivity not high enough for observation of discrete line, hyperdeformed spectra.

